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DOCUMENT-IDENTIFIER: US 6442158 B1

TITLE: Method and system for quality-of-service based data forwarding in a data-over-cable system

Brief Summary Text (4):

The extensive wiring already undertaken to provide cable television service via cable networks and the large bandwidth, relative to that available on competing connections make it an attractive medium for providing access to services such as the Internet. The Internet, a world-wide-network of interconnected computers, provides multi-media content including audio, video, graphics and text that often require a large bandwidth for downloading and viewing.

Brief Summary Text (12):

As a cable modem is initialized in a data-over-cable system, it registers with a cable-modem-termination system. As part of a registration request message, the cable modem forwards configuration information to the cable-modem-termination system. This exchange also establishes the properties of the cable modem to the cable-modem-termination system. If the data-over-cable system supports Quality-of-Service, data-over-cable system may allocate resources to the cable modem in the course of registration.

Brief Summary Text (13):

Configuration information forwarded to a cable-modem-termination system from a cable modem is accompanied by Class-of-Service and Quality-of-Service and other parameters. As is known in the art, Class-of-Service provides a reliable transport facility independent of the Quality-of-Service. Class-of-Service parameters include maximum data rates, maximum upstream data rates, upstream channel priority, guaranteed minimum data rates, guaranteed maximum data rate and other parameters. Quality-of-Service collectively specifies the performance of a network service that a device expects on a network. Quality-of-Service parameters include transit delay expected to deliver data to a specific destination, the level of protection from unauthorized monitoring or modification of data, cost for delivery of data, expected residual error probability, the relative priority associated with the data and other parameters.

Brief Summary Text (15):

Each cable-modem-termination system is an expensive asset. Hence, optimal utilization of its capacity is warranted. In light of the above, adding another cable-modem-termination system is not always the preferred option when faced with increased demands on the system. For instance, users may be allowed to access system resources only after registering and receiving approval for their requested use of system resources. This permits resource allocation based on satisfying the needs of users allowed access to the data-over-cable system and avoid a freezing up the entire system. At the same time system resources do not have to match peak demand while being idle most of the time.

Brief Summary Text (19):

The methods and system include a first network device which receives data from an outside device on a communication channel. The data on the communication channel consist of several different data streams directed at a plurality of applications

within the cable system. As an example, a T1 line may carry several voice and data messages multiplexed together. As is known in the art, a T1 connection has 24 channels multiplexed in the time domain and transmitted at a data rate of 1.054 M bits per second. Not all of these messages may have the same priority, real-time delivery or error-correction requirements. An application or a second network device receiving these messages after the first network device forwards them, presumably negotiated a Quality-Of-Service level, which includes optimal and minimal requirements. It is clear that a mismatch could result if sufficient bandwidth for an application is not available when the data actually streams in. On the other hand, reserving enough bandwidth would result in much of the bandwidth being wasted because its allocation would be dictated by peak demand.

Brief Summary Text (24):

Implementing Quality-of-Service on a cable system presents distinctly different problems compared to other types of networks. There is no need to determine an optimal path due to the tree-structure intrinsic to a cable network but efficient bandwidth utilization is a major concern. In the example, it is possible to use the Quality-of-Service identifiers to determine the allocated-bandwidth. If the available bandwidth is insufficient, the excess data-packets are cached. The cached data packets are transmitted later when bandwidth is available. The foregoing and other features and advantages of a preferred embodiment of the present invention will be more readily apparent from the following detailed description, which proceeds with references to the accompanying drawings.

Detailed Description Text (9):

In addition, FIG. 1 shows the network host interface 42, which is addressed by data-packets being sent to the data-over-cable system. Available addresses in the network host interface 42 can be associated with a SID so that CMTS 12 may route traffic addressed to an address in network host interface 42, to an application corresponding to the associated SID. The QoS server 36 updates a database 44 of the available service capacity on the CMTS 12. The service capacity includes the bandwidth and other parameters included in QoS specifications. QoS server uses the database 44 to track available system resources including bandwidth available on a CMTS 12. In other embodiments some or all of the functions of these servers may be dispensed with, or, alternatively, be made integral to the CMTS 12.

Detailed Description Text (18):

Internet Control Message Protocol ("ICMP") layer 70 is used for network management. The main functions of ICMP layer 70, hereinafter ICMP 70, include error reporting, reachability testing (e.g., "pinging") congestion control, route-change notification, performance, subnet addressing and others. Since IP 68 is an unacknowledged protocol, datagrams may be discarded and ICMP 70 is used for error reporting. For more information on ICMP 70 see RFC-971 incorporated herein by reference.

Detailed Description Text (51):

During initialization, an individual cable modem requests upstream and downstream connections with different Quality-of-Service (QoS) to/from CMTS 12 on cable network 14. QoS collectively specifies the performance of the network service that a device expects on a network. The QoS connections are requested with a registration message sent from CM 16 to CMTS 12. The registration message includes a configuration file. The configuration file is requested by CM 16 from TFTP 78 using an address supplied by the DHCP server 38 as part of the DHCPACK message. The configuration file address supplied by the DHCP server 38 is for the default file. TFTP provides a file tailored to the particular device by using additional information. TFTP 78 maintains a table that permits it to access or construct a configuration file tailored to the specific device (e.g. the particular CM 16 model) requesting it.

Other Reference Publication (13):

Huang, Yin-Hwa et al., Design of an MPEG-Based Set-Top Box for Video on Demand Services, Acoustics, Speech, and Signal Processing, 1995, ICASSP-95., 1995 International Conference, vol. 4, ISBN: 0-7803-2431-5, May 9-12, 1995, pp. 2655-2658.